Analysis of CrIS/ATMS and AIRS/AMSU data using Scientifically Equivalent Retrieval Algorithms A13D-0285

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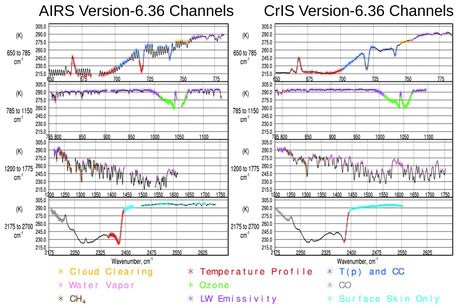
Background

CrIS and ATMS are high spectral resolution IR and Microwave atmospheric sounders currently flying on the SNPP satellite, and are also scheduled for flight on future NPOESS satellites. CrIS/ATMS have similar sounding capabilities to those of the AIRS/AMSU sounder suite flying on EOS Aqua. The objective of this research is to develop and implement scientifically equivalent AIRS/AMSU and CrIS/ATMS retrieval algorithms with the goal of generating a continuous data record of AIRS/AMSU and CrIS/ATMS level-3 data products with a seamless transition between them in time. To achieve this, monthly mean AIRS/AMSU and CrIS/ATMS retrieved products, and more importantly their interannual differences, should show excellent agreement with each other. The currently operational AIRS Science Team Version-6 retrieval algorithm has generated 14 years of level-3 data products. A scientifically improved AIRS Version-7 retrieval algorithm is expected to become operational in 2017. We see significant improvements in water vapor and ozone in Version-7 retrieval methodology compared to Version-6.

We are working toward finalization and implementation of scientifically equivalent AIRS/AMSU and CrIS/ATMS Version-7 retrieval algorithms to be used for the eventual processing of all AIRS/AMSU and CrIS/ATMS data. The latest version of our retrieval algorithm is Verison-6.36, which includes almost all the improvements we want in Version-7. Version-6.28 has been used to process both AIRS and CrIS data for August 2014. This poster compares August 2014 monthly mean Version-6.28 AIRS/AMSU and CrIS/ATMS products with each other, and also with monthly mean products obtained using AIRS Version-6. AIRS and CrIS results using Version-6.36 are presented for April 15, 2016. These demonstrate further improvements since Version-6.28. The new results also show improved agreement of Version-6.36 AIRS and CrIS products with each other. Version-6.36 is not yet optimized for CrIS ozone products.

Sample Cloud Free Brightness Temperature Spectrum



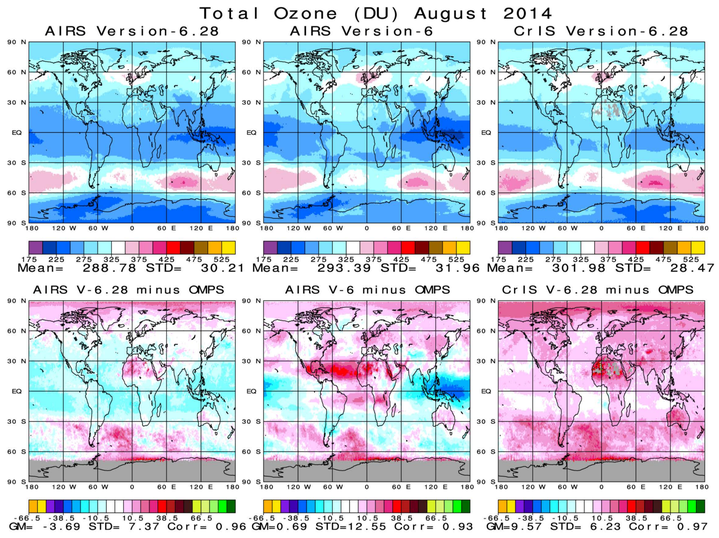
Sample AIRS and CrIS brightness temperatures computed for a cloud free scene. The AIRS and CrIS channels we use in different steps in the retrieval process are indicated in the figures by different colored stars. AIRS is sampled twice as densely as CrIS and extends further at the high frequency end.

Summary

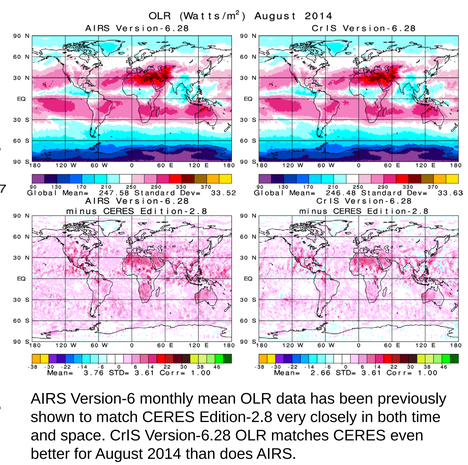
Monthly mean August 2014 Version-6.28 AIRS and CrIS products agree well with OMPS and CERES, and reasonably well with each other. Version-6.28 CrIS total precipitable water is biased dry compared to AIRS. AIRS and CrIS Version-6.36 water vapor products are both improved compared to Version-6.28. Version-6.36 AIRS and CrIS total precipitable water also shows improved agreement with each other. AIRS Version-6.36 total ozone agrees even better with OMPS than does AIRS Version-6.28, and gives reasonable results during polar winter where OMPS does not generate products.

Monthly Mean Products for August 2014

Cross Comparison of AIRS, CrIS, and other NPP Instruments



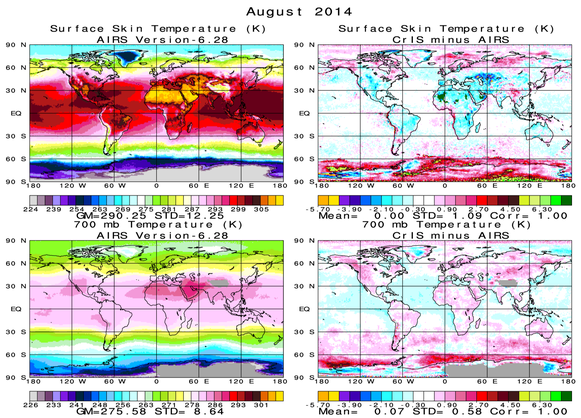
AIRS Version-6.28 monthly mean total ozone agrees much better with OMPS than Version-6 in terms of both spatial standard deviation and spatial correlation coefficients. CrIS total ozone has similar standard deviations and correlations with OMPS as AIRS, but is biased high. We are continuing to improve details of the ozone retrieval algorithm and QC procedures for both AIRS/AMSU and CrIS/ATMS.

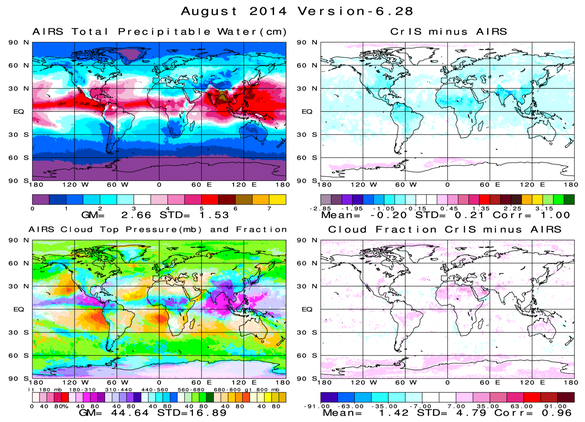


AIRS Version-6 monthly mean OLR data has been previously shown to match CERES Edition-2.8 very closely in both time and space. CrIS Version-6.28 OLR matches CERES even better for August 2014 than does AIRS.

Comparison of AIRS Version-6.28 Product with CrIS Version-6.28

AIRS and CrIS surface skin temperature and 700 mb temperature fields match very well over ocean. Currently, CrIS land skin temperatures are somewhat lower than those of AIRS, which leads to correspondingly higher 700 mb temperature over land for CRIS.



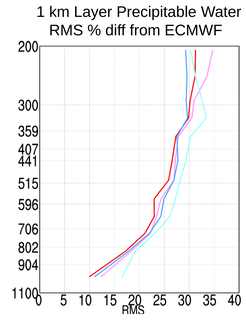


AIRS and CrIS total precipitable water and cloud products also match reasonably well with each other, though Version-6.28 CrIS has less total precipitable water than AIRS in the tropics. Monthly mean Version-6.36 agreement of AIRS and CrIS total precipitable water will be better than Version-6.28.

Improved Version-6.36 Accuracy Compared to Version-6.28

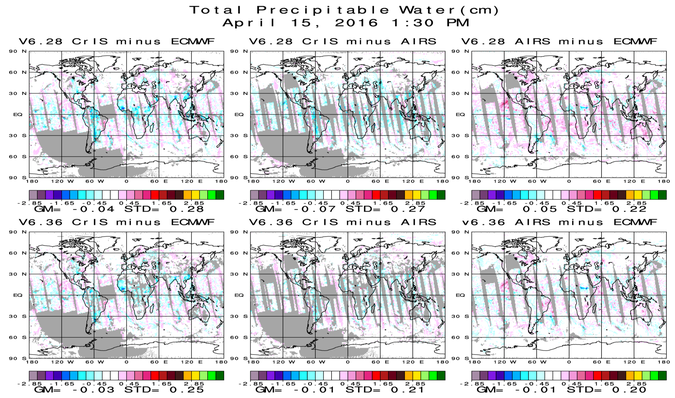
AIRS/AMSU and CrIS/ATMS results passing Climate QC are shown for April 15, 2016.

Water Vapor



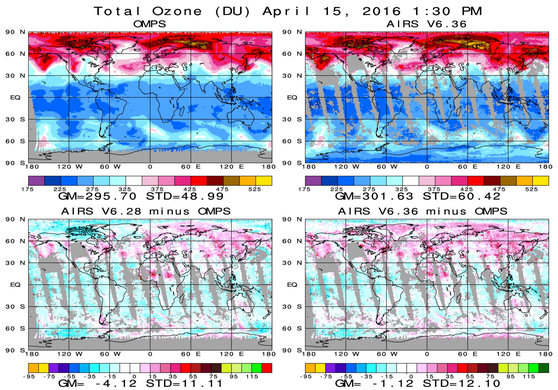
Both CrIS and AIRS Version-6.36 1 km layer precipitable water accuracies with Climate QC have improved compared to those using Version-6.28. CrIS Version-6.36 1 km layer precipitable water with Climate QC is significantly more accurate than that of CrIS Version-6.28, is still slightly poorer than that of AIRS.

AIRS Version-6.28
AIRS Version-6.36
CrIS Version-6.28
CrIS Version-6.36



Both AIRS and CrIS Version-6.36 total precipitable water show better agreement with ECMWF than the corresponding results using Version-6.28. In particular, CrIS Version-6.36 total precipitable water in the tropics is considerably more accurate than Version-6.28 CrIS total precipitable water, but is still somewhat poorer than AIRS Version-6.36. Much of the dry monthly mean bias of CrIS Version-6.28 compared to AIRS Version-6.28 should be alleviated using Version-6.36.

Ozone



AIRS Version-6.36 total ozone agrees even better with OMPS than AIRS Version-6.28. AIRS provides reasonable total ozone products in polar winter, OMPS provides no data in polar winter.